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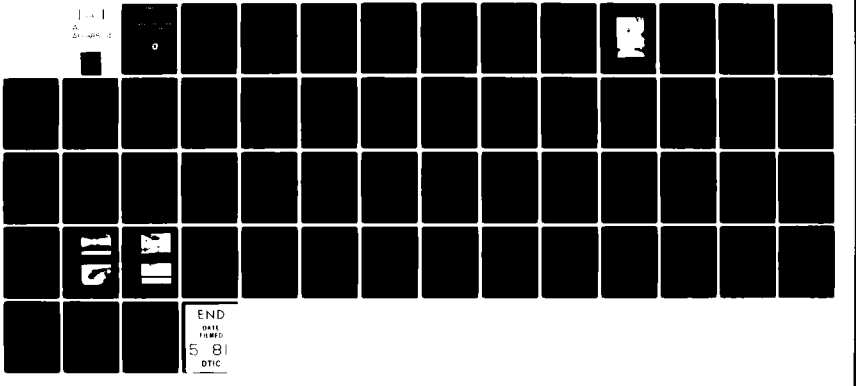

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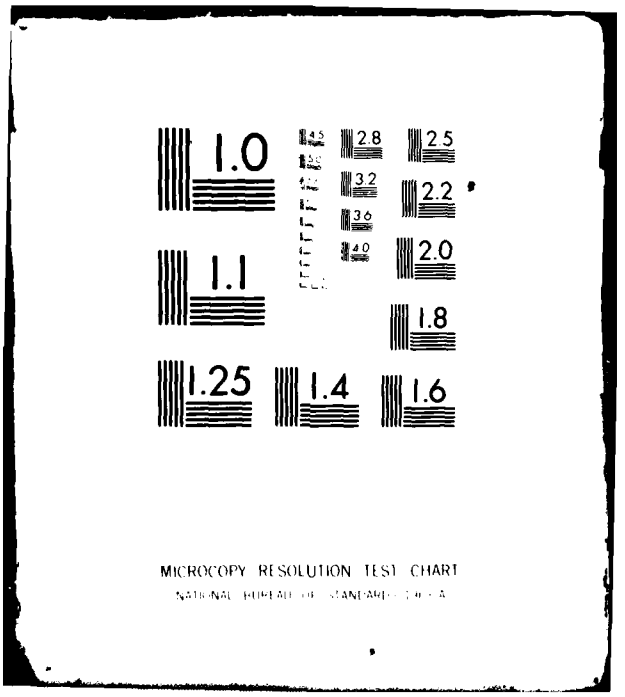
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PASSAIC RIVER BASIN,
VAN WINKLE BROOK, UNION COUNTY,
NEW JERSEY.

(6) National Dam Safety Program.

BRIANT PARK DAM
(NJ 00784)

PHASE 1 INSPECTION REPORT.
NATIONAL DAM SAFETY PROGRAM

(12) (9) Final Rept. (10) Graham/Perera

(15) DACW61-79-C-0011

A

DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO. (12) DAEN/NAP/53842/NJ00784-81/03

(11) MARCH 1981

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program
Embankments	Briant Park Dam, N.J.
Visual Inspection	Spillway
Structural Analysis	Erosion

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

27 APR 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Briant Park Dam in Union County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Briant Park Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in satisfactory overall condition and the spillway is considered adequate. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The following actions should be completed within one year from the date of approval of this report:

(1) The spillway and sidewall masonry should be repaired and repointed.

(2) The bulge in the right sidewall should be monitored for further swelling.

(3) The cover to the valve chamber should be opened and the mechanical components inspected and repaired if necessary to ensure that the valve and outlet function properly.

(4) The chamber cover should be resecured with stout locks. In no event should the valve chamber cover be re-welded shut so as to preclude access to the valve during emergencies.

b. The owner should proceed with the repairs planned for the box culvert, wingwalls and eroded slopes. A detailed report of the repair work should be maintained, and the NJDEP should be notified when the work is completed.

NAPEN-N
Honorable Brendan T. Byrne

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Rinaldo of the Twelfth District. Under the provision of the *Freedom* of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

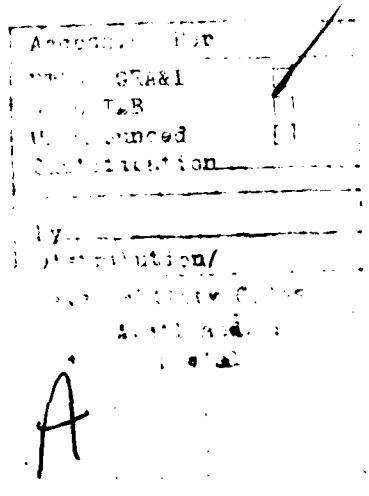
Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625



BRIANT PARK DAM (NJ00784)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 18 August 1980 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Briant Park Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in satisfactory overall condition and the spillway is considered adequate. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The following actions should be completed within one year from the date of approval of this report:

(1) The spillway and sidewall masonry should be repaired and repointed.

(2) The bulge in the right sidewall should be monitored for further swelling.

(3) The cover to the valve chamber should be opened and the mechanical components inspected and repaired if necessary to ensure that the valve and outlet function properly.

(4) The chamber cover should be resecured with stout locks. In no event should the valve chamber cover be re-welded shut so as to preclude access to the valve during emergencies.

b. The owner should proceed with the repairs planned for the box culvert, wingwalls and eroded slopes. A detailed report of the repair work should be maintained, and the NJDEP should be notified when the work is completed.

c. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

d. An emergency action plan should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within six months from the date of approval of this report.

APPROVED: _____
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 21 April 1981

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam Briant Park Dam Fed ID# NJ 00784

State Located	New Jersey
County Located	Union
Coordinates	Lat. 4042.9 - Long. 7420.1
Stream	Van Winkle Brook
Date of Inspection	August 18, 1980

ASSESSMENT OF GENERAL CONDITIONS

Briant Park Dam is assessed to be in satisfactory overall condition. It is recommended that the hazard classification be downgraded to significant, as overtopping could cause extensive damage to downstream property. Remedial actions recommended to be taken in the future include the repair and repointing of the spillway and sidewalls masonry. The spillway of the dam can accommodate 108% of the design flood and is therefore adequate.

Abraham Perera P.E.
Project Manager

OVERVIEW OF BRIANT PARK DAM

AUGUST, 1980

TABLE OF CONTENTS

FIGURES

APPENDIX

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM BRIANT PARK DAM FED ID# NJ 00784

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Engineer District, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Briant Park Dam and appurtenant structures and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Briant Park Dam is a 50-year-old earthen roadway embankment approximately 280 feet long and 15.5 feet high with a variable top width ranging from 50 to 60 feet. A 50-foot-long concrete-arch ogee spillway is positioned 30 feet upstream of a 10 foot by 12 foot concrete culvert that passes under the roadway. Convexly curved concrete retaining walls extend past the ends of the spillway to the culvert entrance. Stone drains behind the retaining walls consist of 2.5-inch crushed stone with 3-inch weepers that empty into the culvert. Two 2-foot-thick core walls extend 15 feet into the embankment from the intersection of the spillway and the retaining walls. A 36-inch diameter reinforced concrete drain pipe empties into the culvert and is controlled by a gate valve located in a concrete manhole behind the right retaining wall.

b. Location

Briant Park Dam is located on Briant Avenue approximately 200 feet southeast of its intersection with Morris Avenue. The dam is situated across Van Winkle Brook, the boundary line between the towns of Springfield and Summit in Union County, New Jersey.

c. Size Classification

The maximum height of the dam is 15.5 feet and the maximum storage is estimated to be 55 acre-feet. Therefore, the dam is placed in the small size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

Based on the Corps of Engineers criteria and the fact that, in the event of a failure, some damage could be inflicted on downstream property, it is recommended that the classification of the dam be downgraded to significant hazard. Private residences located along Morris Avenue immediately downstream are generally 15 feet or more above the stream channel. However, 1,000 feet downstream there is a NJDOT maintenance facility located on the flood plain about 6 to 8 feet above the channel bottom where extensive damage could result in the event of a dam failure. Moreover, Briant Avenue would undoubtedly sustain significant damage should overtopping or a spillway failure occur.

e. Ownership

Briant Park Dam is owned by the County of Union Park Commission whose mailing address is P.O. Box 607, Westfield, New Jersey, 07091.

f. Purpose of Dam

The dam was constructed to create a pond for ice skating and summer recreational use.

g. Design and Construction History

Briant Park Dam was originally designed and constructed in 1930 by the Union County Park Commission. The original design consisted of an

earthen roadway embankment containing a temporary log box spillway. The original structure failed in July 1938 and the dam was redesigned employing a reinforced concrete box culvert with concrete wingwalls and an arch spillway section. Construction of the new structure was completed in 1939.

h. Normal Operating Procedures

There are no specific operating procedures in force at present, although the owner performs general maintenance and repairs as a matter of routine.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of Briant Park Dam is 1.3 square miles.

b. Discharge of Dam Site

The spillway capacity with the lake at the abutment top elevation is calculated to be approximately 1,528 cfs. No discharge records are available at this site. However, earlier dam applications indicate a design discharge of 630 csm. A check of the design calculations revealed an arithmetical error that, when corrected, increased the design discharge to 785 csm.

c. Elevation (Above M.S.L.)

Top of dam - 191.5
Recreation pool - 186.5
Streambed at center line of dam - 176.0

d. Reservoir

Length of recreation pool - 600 feet
Length of maximum pool - 750 feet

e. Storage

Recreation pool - 18.5 acre-feet
Top of dam - 55 acre-feet

f. Reservoir Surface

Recreation pool - 5 acres
Top of dam - 9.5 acres

g. Dam

Type - Earth embankment with concrete spillway
Length - 280 feet
Height - 15.5 feet
Freeboard between normal reservoir and top of dam - 5 feet
Top Width - 60 feet
Side Slopes - Upstream 4%; downstream 2H:1V
Zoning - composition and compactness unknown
Core Wall - 15-foot-long by 2-foot-thick concrete walls from EL. 188 to 172.5 at junctions of spillway and retaining walls

h. Diversion and Regulating Tunnel

None

i. Spillway

Type - reinforced concrete ogee weir
Effective length of weir - 50 feet
Crest elevation - 186.5

j. Regulating Outlets

1- 36" diameter RCP drain at exit invert elevation 176.5

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design information pertaining to the original 1930 construction was located with the exception of hydraulic calculations for the spillway and culvert design. However, a plan detailing the 1938 reconstruction of the spillway, culvert, and retaining walls was available for review. The work was designed by W. R. Tracy of the Union County Park Commission. No details were available for the embankment, which was constructed eight years earlier.

2.2 CONSTRUCTION

The spillway structure and culvert were built in accordance with the designer's specifications. Periodic inspections were performed during construction by personnel of the State Water Policy Commission. The work appears to have been properly supervised and executed in a satisfactory manner.

2.3 OPERATION

The dam appears to have operated satisfactorily since its reconstruction following the 1938 failure.

2.4 EVALUATION

a. Availability

In view of the size and present configuration of the dam, it is felt that sufficient engineering data are available to properly assess its condition with respect to the stability and hydraulic capacity of the dam. Construction inspection reports indicate that footings for the spillway and culvert were carried down to a compact gravelly hard pan facies of the glacial moraine, which is the predominate surface deposit in this area. The dam is located in an area where the Brunswick Shale and basalt of the First Watchung lava flow lie in unconformable juxtaposition. Depth to bedrock at this locale averages 20 to 30 feet.

b. Adequacy

The 1938 plan indicates that the arch spillway and culvert were carefully and conservatively designed, and field inspection reveals the structures were built in accordance with the design plan. Accordingly, the available engineering and geotechnical data are considered adequate for the purpose of this report.

c. Validity

The hydrologic and hydraulic calculations employed in the design of the structure are consistent with good conservative engineering practices at the time of construction. Although the type of embankment construction is unknown, field observations indicate that both sides of the earth portion of the dam have been filled and elevated, reducing the importance of the original embankment make-up. Therefore, the validity of the 1938 design plan is not questioned and is accepted without recourse to further investigations.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of Briant Park Dam took place on August 19, 1980 with engineering personnel of the County of Union, the U.S. Army Corps of Engineers, and the Department of Environmental Protection, Bureau of Floodplain Management in attendance. Historical aspects of the dam's operation were discussed with the owner's representatives, as were the maintenance procedures. The dam appears to be in a generally satisfactory condition except as noted below.

b. Dam

The 1938 Dam Permit Application indicates the structure is a 280-foot-long roadway embankment. However, both the upstream and downstream slopes have been so modified by widening of the roadway as well as park and residential development that discernment of the original shape and extent of the embankment is virtually impossible. The upstream face of the dam slopes very gently toward the lake and is covered with a stand of trees and bushes on both sides of the spillway. While the downstream embankment of the dam is also well treed, it appears somewhat steeper in the vicinity of the outlet culvert, approximating a 2H:1V slope. Briant Avenue, an asphalt-paved roadway, extends along the crest of the dam, which has a saddle at the location of the outlet structure. Although the roadway has slip-curbing on both sides to channelize surface runoff, severe erosion of the downstream embankment behind the headwall of the culvert has resulted in undermining of the headwall, collapse of the left downstream wingwall, and failure of the right end of the cantilevered headwall. Large stone weighing up to 500 pounds appears to have been dumped on both sides of the culvert to help retard the erosion.

c. Appurtenant Structures

The concrete arch spillway and retaining walls contain rubble-stone veneer on all exposed faces. With the exception of minor cracking of the mortar between the facing stone, the spillway appears to be in excellent condition despite its age. Similarly, the retaining walls and culvert entrance appear in good condition, although a few surface blocks are missing from the right retaining wall, where cracking and a slight bulge was noted in the top seven courses of block. Although the weep holes were dry at the time of the inspection, water was emanating from the 36-inch drain, which, since the valve was reputedly closed at the time, suggests that either the valve or the seat has deteriorated and requires repair. Moreover, the cast iron cover plates on the manhole containing the gate valve for the drain are welded shut, making access to the gate valve impossible in the event of an emergency dewatering situation. The downstream top wall of the culvert is completely undermined, and the left end of the wall is cantilevered for a distance of approximately five feet. The wingwall adjoining the left side of the culvert has collapsed into the downstream channel, and severe erosion behind the right wingwall threatens a similar fate for that structure. Very light debris was noted at the spillway crest.

d. Reservoir Area

The area immediately surrounding the lake is part of the County of Union Park system and, as such, is protected against development. Beyond the boundaries of the park to the northwest lies the heavily residential development of the town of Summit. To the southeast of the park is the relatively undeveloped industrial area of the town of Springfield. The slopes on both sides of the lake are relatively gentle and lightly wooded to the southeast. The lake, which apparently is subject to heavy silting, was being dredged at the south end at the time of the inspection.

e. Downstream Channel

The stream immediately below the outlet is incised rather deeply (approximately 15 feet) in the surrounding terrain. The channel itself, although littered with light debris and some

heavy stone, is for the most part open and free flowing. About 500 feet downstream the channel makes an abrupt right turn and widens toward the left bank as the stream curves around the nose of a water gap in the First Watchung Mountain. Beyond the lithologic constriction of the Watchungs, the flood plain widens and meanders until the stream merges with the Rahway River about two miles downstream.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were not physically observed by the inspection team. Discussions with personnel of the Union County Park Commission indicate that, except for monitoring of the park and facilities, no formal operational procedures are presently in effect at this dam.

4.2 MAINTENANCE OF DAM

Maintenance is carried out as part of the Park Commission's continuous program in which periodic inspections are conducted and repairs undertaken as allowed by funding limitations. At the time of the inspection, dredging of the south end of the lake was being performed utilizing a mudcat and a clam-type bucket. Discussions with County engineers indicate that plans are being completed for repair of the downstream wingwalls and control of the erosion in that area. Included in the routine maintenance program is landscaping and cleaning of all facilities at the park including the waterways.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operating facility at this dam is the low-level drain whose controls are located in a manhole behind the right retaining wall. Apparently this facility is presently inoperative since the gate wheel is missing and the cover plates to the manhole are welded shut.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

Park Commission personnel monitor the area during periods of heavy storms. They do not have a formalized plan for contacting civil defense or other authorities but rely on their own monitoring and in-house methods of alerting local authorities.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

In view of the limited extent of regulatory facilities at the dam, the present day-to-day procedures are deemed adequate. However, a definitive set of procedures for lowering the lake level and the assignment of responsible personnel to perform this task during impending emergency situations is believed necessary to reduce the potential for overtopping the dam.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the criteria in the Recommended Guidelines for Safety Inspection of Dams, the 100-year frequency event was selected as the design storm by the inspecting engineer. Precipitation data were obtained from Technical Paper 40 and NOAA TM NWS Hydro 35. Inflow to the reservoir for the design storm was computed utilizing the HEC-1 computer program. This gave a peak inflow into the reservoir of 1,909 cfs with subsequent routing through the reservoir reducing the peak to 1,781 cfs. The spillway has a maximum discharge capacity of approximately 1,920 cfs before overtopping occurs and can therefore accommodate 108% of the design flood.

b. Experience Data

The original dam, constructed as an earth embankment with a log box spillway, failed in July 1938. The reconstructed structure (completed in 1939) has performed well with the exception of at least one overtopping in 1968. No details of the overtopping or damages resulting therefrom are available.

c. Visual Observations

The lake level was at normal pool at the time of inspection, with a minimal amount of water flowing over the weir.

d. Overtopping Potential

There is a record of one overtopping in 1968 according to county engineering department records. However, if the dam should be overtopped again it could create erosion damage to the shoulders and the paving of the road crossing over the concrete culvert just downstream of the dam, particularly on the downstream shoulder and slope, which have suffered severe erosion in the past.

e. Drawdown Potential

Drawdown can be accomplished by a 36-inch diameter concrete outlet pipe (entrance invert at elev. 181.0) in approximately 5 hours. This is considered adequate to relieve the dam from being overtopped by exceptional floods.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Based on the field inspection and available documentation on the past construction history of the dam, as reconstructed in 1939, the structural stability of the dam is of little concern. The circular spillway side walls, faced with stone masonry, show some deterioration that should be repaired. Several pieces of masonry need replacement, and in several other places the joints need repointing. Some of the spillway masonry joints also need repointing. Otherwise, the dam has proven its structural stability over the years, including the ability to withstand overtopping.

b. Design and Construction Data

Briant Park Dam, after its failure as an earth dam in 1938, was reconstructed in masonry and concrete in 1939. The dam has performed in a satisfactory manner since then. Under the context of this report, additional design data would not basically alter any condition insofar as the downstream flooding conditions are concerned.

c. Operating Records

Written operating records are nonexistent; however, the owner performs maintenance and repairs when needed.

d. Post Construction Changes

There are no records of any significant alterations or repairs of the dam since 1939. The owner is presently undertaking the repair of the slopes and the downstream wingwalls of the concrete box culvert, which have sustained considerable damage.

e. Seismic Stability

This dam is stable under earthquake acceleration loadings. It is located in Seismic Zone 1, and experience reveals that such low dams with indeterminate width-to-height ratios will have adequate stability under dynamic loading conditions if they are stable under static gravity conditions.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/ REMEDIAL ACTIONS

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitations of the Phase I visual inspection, the Briant Park Dam is judged to be in a satisfactory overall condition. The spillway can accommodate 108% of the dsign flood, so overtopping is a remote possibility. However, should the spillway or the dam fail, significant damage could occur to downstream property (see Section 1.2 d).

b. Adequacy of Information

The data located are deemed adequate regarding the enclosed analysis on safe operation and stability.

c. Urgency

In view of the dam hazard assessment, no urgency is attached to implementing further studies. It is recommended that the remedial measures set forth below be taken under advisement in the future.

d. Necessity for Further Study

Further studies are believed to be unnecesary under the purview of P.L. 92-367 as the Engineering Department of the County of Union, which is responsible for the safety of the Briant Park Dam, has experienced engineering personnel to maintain the dam and monitor it during severe storms. This fact, coupled with the demonstrated stability of the dam since 1939, should satisfy the requirements mandated under the Dam Inspection Act.

7.2 RECOMMENDATIONS/REMEDIAL MEASUREMENTS

a. Recommendations

It is recommended that the spillway and sidewall masonry be repaired and repointed and that the bulge in the right sidewall be monitored for further swelling. The cover to the valve chamber should be opened and the mechanical components inspected and repaired if necessary to ensure that the valve and outlet function properly. The

chamber cover should be resecured with stout locks. In no event should the valve chamber cover be re-welded shut so as to preclude access to the valve during emergencies. The owner should proceed with the repairs planned for the box culvert, wingwalls, and eroded slopes. A detailed report of the repair work should be maintained, and the NJDEP should be notified when the work is completed.

b. O&M Maintenance and Procedures

In the near future the owner should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam. Additionally, further inspections should be properly recorded and the owner should develop an emergency action plan and warning system to minimize downstream flooding hazards.

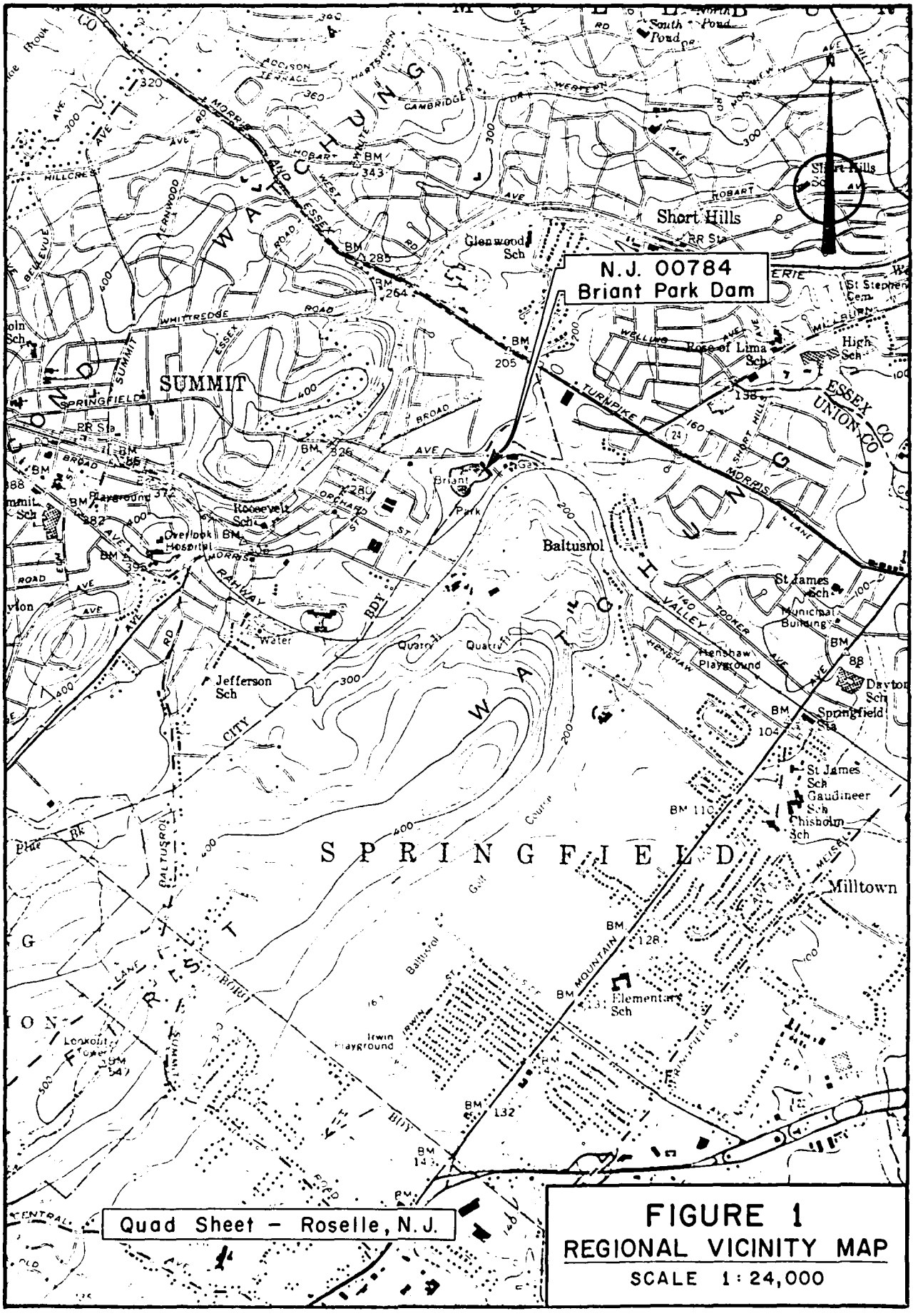
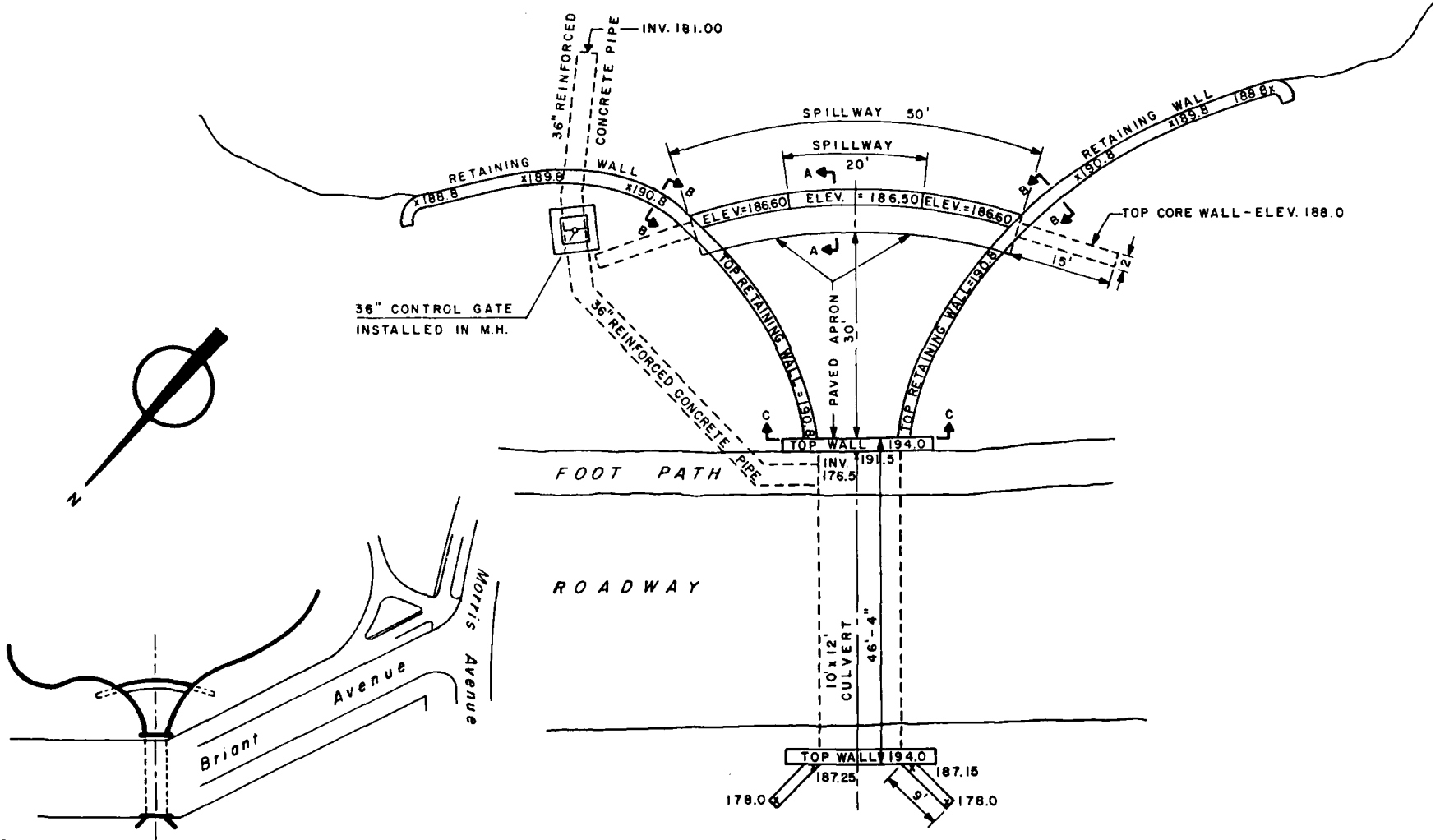


FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24,000



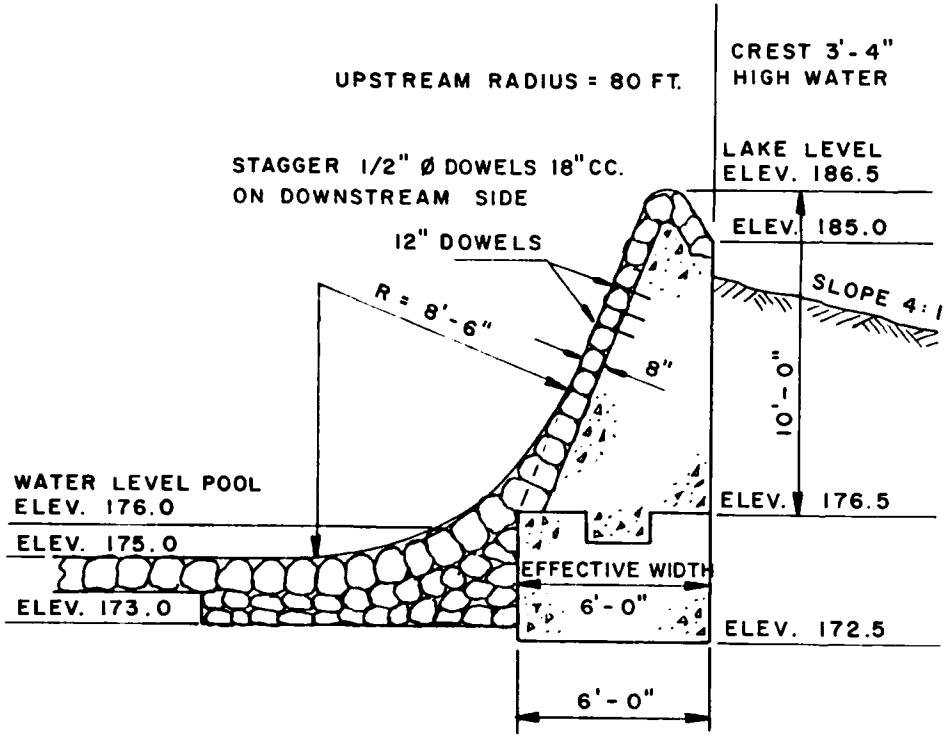
LOCATION PLAN

PLAN VIEW OF DAM

NOT TO SCALE

BRIANT PARK DAM

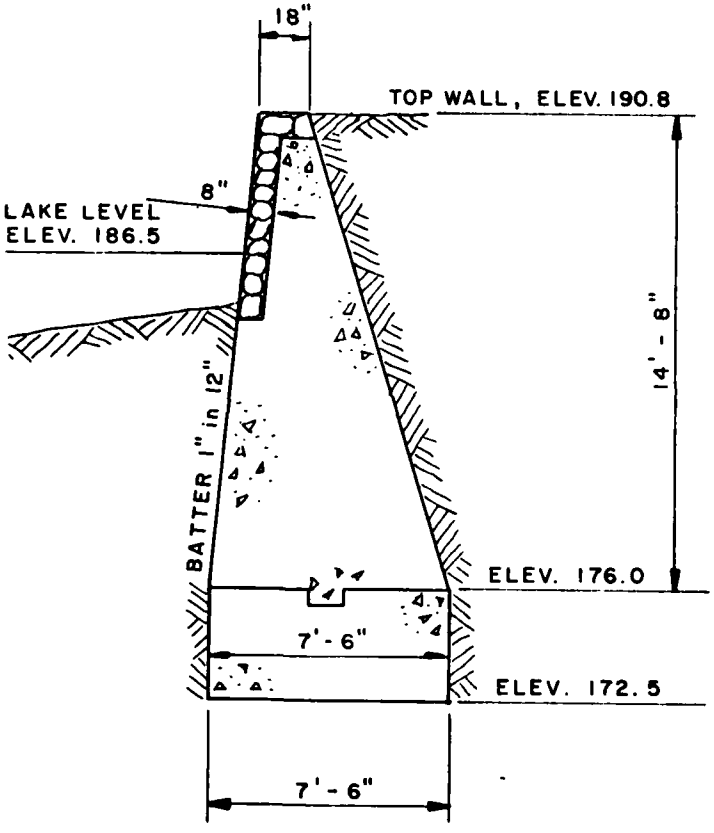
FIGURE 2



SECTION A-A

SECTION THRU CENTER OF DAM

NOT TO SCALE



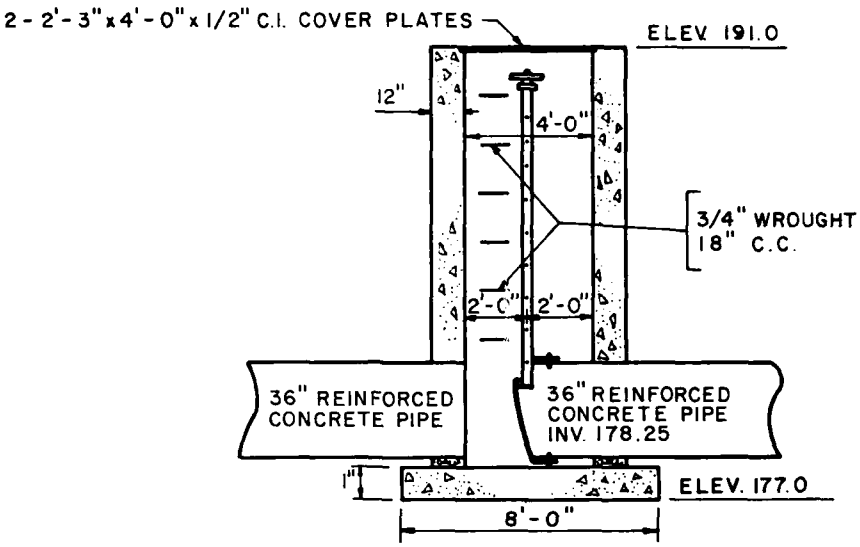
SECTION B-B

SECTION THRU RETAINING WALL

NOT TO SCALE

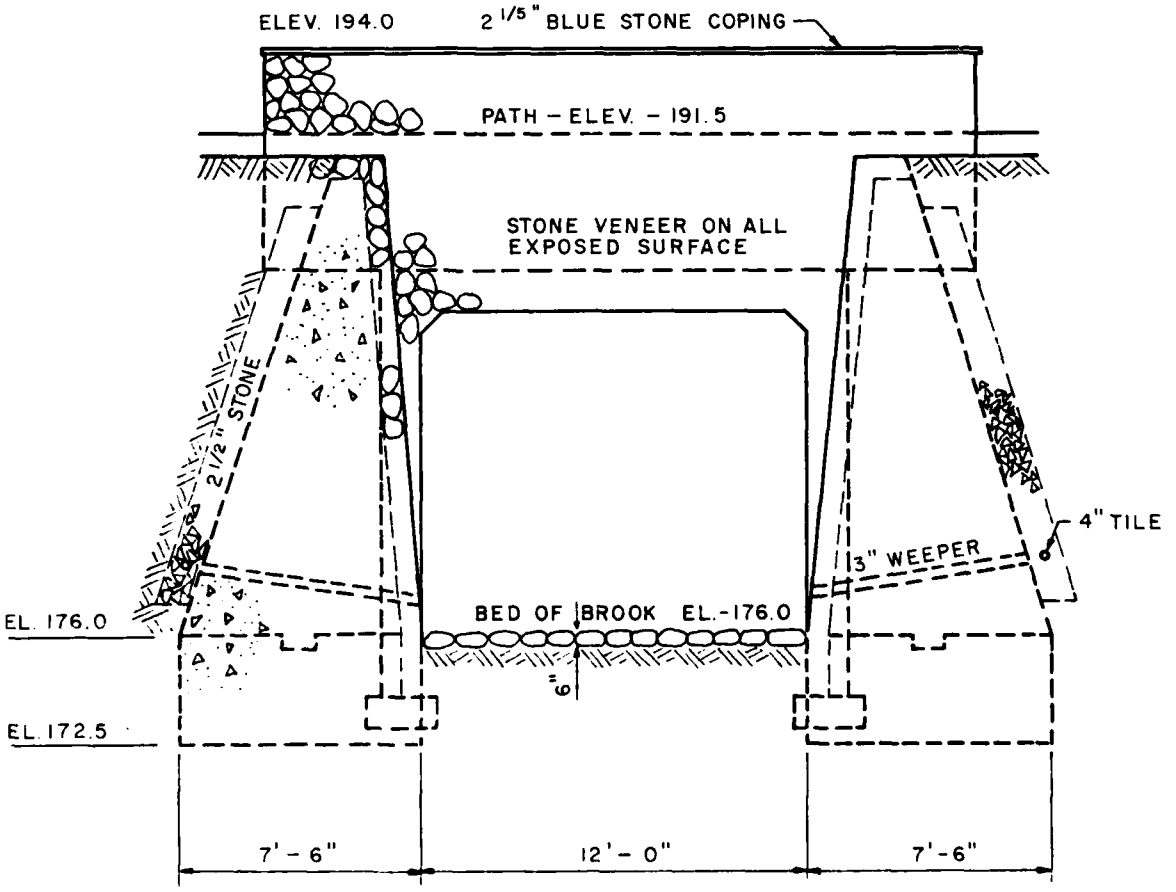
FIGURE 3

BRIANT PARK DAM



OUTLET CONTROL STRUCTURE SECTION

NOT TO SCALE



SECTION C-C

SECTION THRU CULVERT

NOT TO SCALE

BRIANT PARK DAM

FIGURE 4

Check List
Visual Inspection
Phase 1

Name Dam Briant Park Dam County Union State New Jersey Coordinators NJDEP

Date(s) Inspection 8/19/80 Weather Overcast Temperature 75°C

Pool Elevation at Time of Inspection 186.5 M.S.L. Tailwater at Time of Inspection 176 M.S.L.

Inspection Personnel:

A. Perera (LBA)	T. Chapter (LBA)	B. Mulvenna (COE)
J. Greenstein (LBA)	J. Moyle (NJDEP)	M. Cerra (U.C.P.C.)
R. Lang (LBA)		A. Fioretti (U.C.P.C.)

T. Chapter Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None Observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Observed	Front and back slopes almost undiscernable due to filling to accomodate park and residential development.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Severe erosion behind top wall and wingwalls at downstream end of outfall culvert. One wingwall has collapsed, second in danger of failure, right end of headwall missing, 5-foot section at left end of headwall undermined and cantilevered 5 feet above erosion gully.	Failed walls should be reconstructed or repaired where necessary. Eroded areas should be filled and erosion protection provided in areas of high velocity runoff. Repairs by Park Commission currently in planning stage.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Roadway extends along dam crest. Low point of road (saddle) located at outlet structure.	Roadway runoff creating erosion problem noted above. Must be diverted or slope protection (riprap or paving) provided.
RIPRAP FAILURES	Large stone dumped in eroded areas near outlet structure. Either too late or unsuccessful in halting erosion. Stone now at channel bottom.	Stone should be redistributed over erosion-prone areas.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Trees and brush growing on both embankments. Well-manicured landscaping on both sides of roadway crest.	The vegetation is not detrimental to the integrity of the embankment. Trees behind right retaining wall at spillway may be exerting pressure on wall. Slight bulge in wall should be monitored.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junction of embankment and abutments are indistinguishable. Spillway/embankment junctions in good condition.	
ANY NOTICEABLE SEEPAGE	Not Noted	
STAFF GAGE AND RECORDER	None	
DRAINS	Unknown	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None Observed	
INTAKE STRUCTURE	Not Observed	Below lake surface elevation.
OUTLET STRUCTURE	Empties into side of road culvert. Concrete appears in good condition. Light emissions noted.	Either gate valve seal is leaking or gate was partially opened by park employees working on dredging operation. Should be checked and repaired if necessary.
OUTLET CHANNEL	Box culvert under road in good condition.	
EMERGENCY GATE	Condition of gate valve unknown at this time.	Should be tested and repaired if necessary.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Covered with masonry veneer in good condition. Side retaining walls in fair condition. Some masonry blocks missing, and cracking of mortar noted. Slight bulge in veneer on right wall. Probably frost-action related.	Minor repointing necessary at spillway. Masonry veneer not necessary for structural integrity, although it prevents weathering of the concrete structure. Blocks should be replaced and cracks repointed.
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	Some large stone downstream, moderately vegetated with steep, relatively high side slopes. Stone stilling basin clear and appears in good working condition.	3 inch dia. weep drains in the side walls were dry at the time of inspection.
BRIDGE AND PIERS	Roadway box culvert about 30 feet downstream from spillway. Culvert and spillway hydraulic capacity approximately equal.	Calcs. indicate dam is overtopped about time culvert becomes the control.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The lake is bordered by gently sloping woodlands to the east and south and by a somewhat steeper residential area to the southwest and west.	Area immediately around lake is moderately flat, nicely landscaped, undeveloped park lands.
SEDIMENTATION	The lake was being dredged at the time of the inspection by park personnel using a mudcat and a clamshell dredge.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC)	Deeply incised channel with some large stone and moderately dense vegetation along stream bottom. Telephone poles on side of channel.	Channel appears to be self-cleaning during heavy runoff.
SLOPES	Steep and wooded on right side of channel. Some homes back from channel on left.	Homes are above flood stage elevation. Channel appears sufficiently deep and wide to accommodate a dam break flood in this area.
APPROXIMATE NO. OF HOMES AND POPULATION	No homes located on flood plain. NJDOT maintenance facility located about 1000 feet downstream some 6 to 8 feet above channel bottom.	Could be inundated in the event of dam failure.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available - Union County Park Commission, P.O. Box 607, Westfield, N.J. 07091
REGIONAL VICINITY MAP	Available - U.S.G.S. Quadrangle - Roselle, N.J.
CONSTRUCTION HISTORY	Available - NJDEP microfilm, NJDEP, Prospect St., Trenton, N.J.
TYPICAL SECTIONS OF DAM	Available - Union County Park Commission
HYDROLOGIC/HYDRAULIC DATA	Available - NJDEP microfilm
OUTLETS - PLAN	Available - Union County Park Commission
- DETAILS	Available - Union County Park Commission
- CONSTRAINTS	Not Available
- DISCHARGE RATINGS	Not Available
RAINFALL/RESERVOIR RECORDS	Not Available

ITEM	REMARKS
SPILLWAY PLAN	Available - Union County Park Commission
SECTIONS	Available - Union County Park Commission
DETAILS	Available - Union County Park Commission
OPERATING EQUIPMENT	Available - Union County Park Commission
PLANS & DETAILS	Available - Union County Park Commission

ITEM	REMARKS
DESIGN REPORTS	Not Available
GEOLOGY REPORTS	Available - State Geologic Map and Rutgers Engineering Soil Survey
DESIGN COMPUTATIONS	Available - NJDEP microfilm
HYDROLOGY & HYDRAULICS	Avialable - NJDEP microfilm
DAM STABILITY	Not Available
SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS	Not Available
BORING RECORDS	Not Available
LABORATORY	Not Available
FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	Patrolled by park personnel
MODIFICATIONS	Available - NJDEP microfilm
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Dam overtopping reported on NJDEP microfilm Description of overtopping damage not available on microfilm Not Available
MAINTENANCE OPERATION RECORDS	Available - Union County Park Commission Available - Union County Park Commission Available - Union County Park Commission

August, 1980

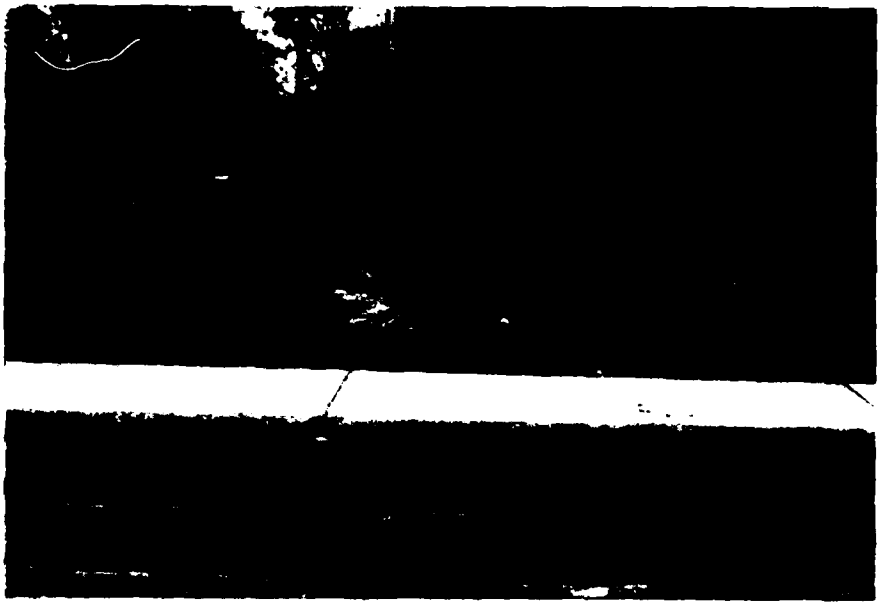
View of Briant Lake from Dam

August, 1980

View of Spillway and Retaining Wall

August, 1980

View of Culvert Outlet



August, 1980

View of Downstream Channel

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.3 sq. mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 186.5 (18.5 acre feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: N/A

ELEVATION TOP DAM: 191.5 (55 acre feet)

CREST: Arched masonry spillway

a. Elevation 186.5
b. Type Ogee
c. Width 1.5± Feet
d. Length 50 Feet
e. Location Spillover Near right abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type Gate operated 36" dia. RCP
b. Location Between spillway and right abutment
c. Entrance inverts 181.0
d. Exit inverts 176.5
e. Emergency draindown facilities Same

HYDROMETEOROLOGICAL GAGES: None
a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 1920 cfs

BY _____ DATE Feb 81 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A1 OF A-13

CHKD. BY _____ DATE _____ Laurel Mall Dev. PROJECT 2262

SUBJECT Time of Concentration

1. Longest drainage watercourse = 6200 ft.

$\Delta H = 153.5$ ft. - Slope = $\frac{153.5 \times 100}{6200} = 2.5\%$

Assume velocity of 2 fps

$\therefore T_c = \frac{6200}{2 \times 3600} = 0.86$ hr.

Overland flow = 2300 ft.

$\Delta H = 115'$ - slope = $\frac{115 \times 100}{2300} = 5.0\%$

Assume velocity of 3 fps

$\therefore T_c = \frac{2300}{3 \times 3600} = 0.32$ hrs. Total $T_c = 1.18$ hrs

2. California Culverts Method:

$T_c = \left(\frac{11.9 (1.17)^3}{153.5}\right)^{0.385} = 0.44$ hrs. for channel flow

From above; Overland $T_c = 0.32$ - Total $T_c = 0.76$ hrs.

3. SCS Method

Assume S_2 for watershed = 66

Slope = 3.0 %

$\ell = 3500$ ft.

$$L_{ag} = \frac{\ell^{0.8} (S+1)^{0.7}}{1900\, y^{0.5}} = 1.51 \text{ hrs}$$

$T_c = L_{ag} / 0.6 = 2.51$ hrs

Avg. $T_c = \frac{1.18 \text{ hr} + 0.73 \text{ hr} + 2.51 \text{ hr}}{3} = 1.48$ hrs.

T_c 0.6 = 2.[illegible] .92 hrs.

$$q_p = \frac{484\,(1.30)\,1.0}{1.02} = 617 \text{ cfs}$$

Unitgraph Time Hours	T/T_p	Dimensionless Ordinate (D.O.)	Q (CFS) $Q_p \times$ D.O.
0.25	0.25	0.118	73
0.50	0.49	0.415	256
0.75	0.74	0.818	505
1.00	0.98	0.997	615
1.25	1.23	0.896	553
1.50	1.47	0.687	424
1.75	1.71	0.483	298
2.00	1.96	0.34	210
2.25	2.21	0.312	193
2.50	2.45	0.168	104
2.75	2.70	0.114	70
3.00	2.97	0.082	51
			Σ 3352

Check $\frac{3352 \times [illegible] \times [illegible]}{[illegible]} = 0.999 \cong 1.0$ [illegible]

BY _____ DATE 1-15-81 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A3 OF A13

CHKD. BY _____ DATE _____ Grant Price Dam PROJECT C-262

SUBJECT Test Storm: 100 Year Frequency

Precipitation data from TP-40 & NOAA Technical Memorandum NWS Hydro-35

Time	Precipitation	Δ	Rearranged Δ
0.25	1.7	1.7	0.06
0.50	2.4	0.7	0.06
0.75	2.8	0.4	0.06
1.00	3.1	0.3	0.06
1.25	3.4	0.3	0.07
1.50	3.7	0.3	0.08
1.75	3.86	0.16	0.09
2.00	4.00	0.14	0.11
2.25	4.11	0.11	0.14
2.50	4.22	0.11	0.30
2.75	4.31	0.09	0.30
3.00	4.40	0.09	0.70
3.25	4.49	0.09	1.70
3.50	4.57	0.08	0.40
3.75	4.64	0.07	0.30
4.00	4.71	0.07	0.16
4.25	4.78	0.07	0.11
4.50	4.84	0.06	0.09
4.75	4.90	0.06	0.09
5.00	4.96	0.06	0.07
5.25	5.02	0.06	0.07
5.50	5.08	0.06	0.06
5.75	5.14	0.06	0.06
6.00	5.20	0.06	0.06

BY D. Lang DATE Aug '80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A4 OF A13

CHKD. BY ______ DATE ______ [illegible] Park Dam PROJECT C-262

SUBJECT Spillway Discharge Capacity

CALCULATE SPILLWAY DISCHARGE

LENGTH OF SPILLWAY NOTCH = 20'

DEPTH OF NOTCH = 0.1 FT

FORMULA USED $Q = C L H^{3/2}$ WHERE C = VARIABLE

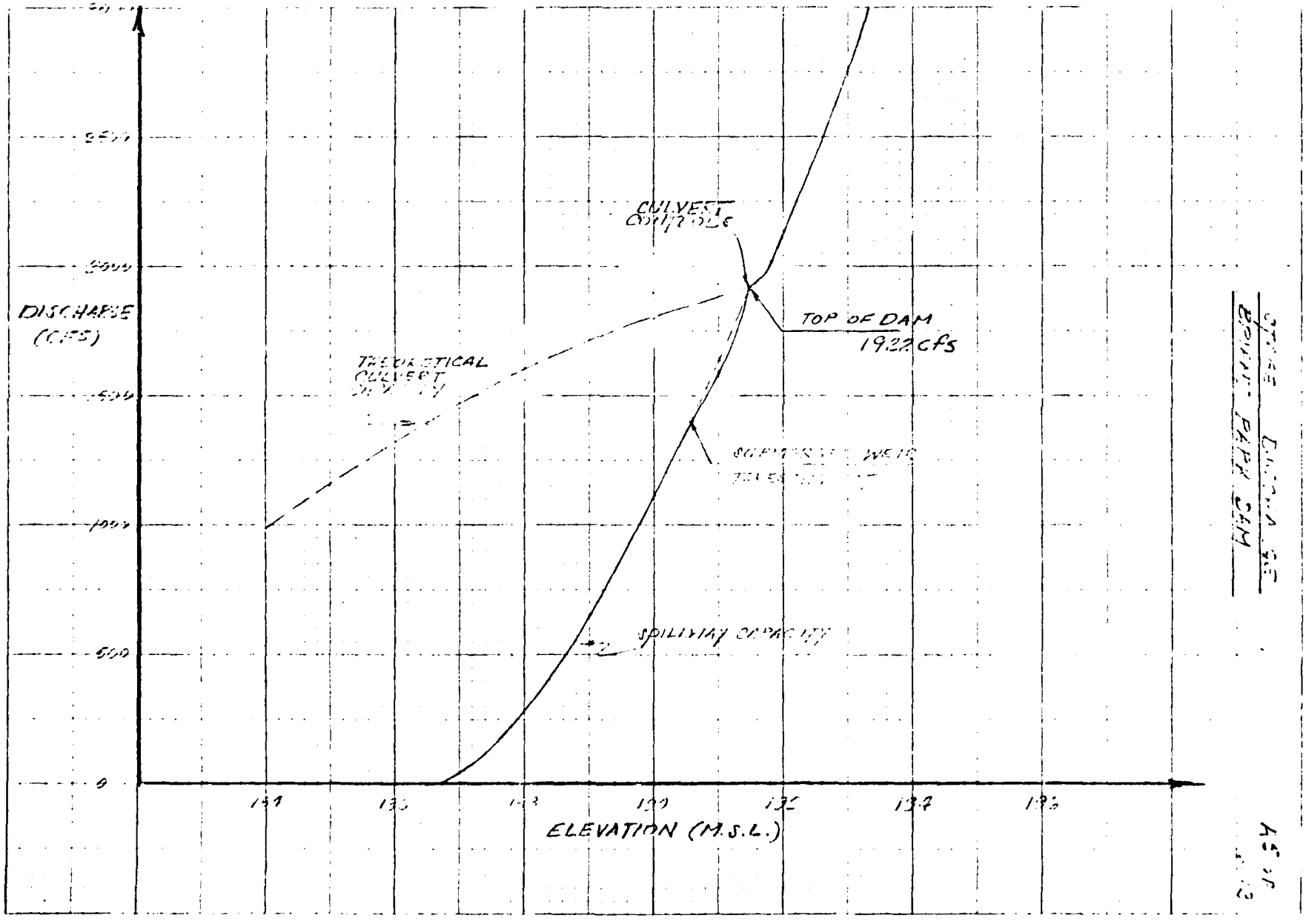
REMAINING SPILLWAY LENGTH = 30' ∴ 50' TOTAL

ELEV (MSL)	SPILLWAY NOTCH H	L	C	Q	DAM SPILLWAY H	L	C	Q	OVER DAM H	L	C	Q	ΣQ	
186.50	0												0	
186.60	0.1	20	3.1	2	0	30							2	
187.00	0.5	20	3.2	23	0.4	30	3.2	24					47	
188.00	1.5	20	3.3	121	1.4	30	3.3	164					285	
189.00	2.5	20	3.4	269	2.4	30	3.4	379					648	
190.00	3.5	20	3.5	458	3.4	30	3.5	658					1116	
190.50	4.0	20	3.5	624	4.2	30	3.5	904					1528	TOP OF RETAIN. WALL
191.00	4.5	20	3.5 T / 3.4 A	668 T / 649 A	4.4	30	3.5 T / 3.44 A	969 T / 941 A	T: THEORETICAL	A: ACTUAL			1637 T / 1590 A	
191.50	5.0	20	3.5	783	4.9	30	3.5	1139	0	100	2.7	0	1922	TOP OF DAM
													2221	
192.00	5.5	20	CULVERT		5.4	30	CULVERT		0.5	100	2.7	95		
193.00	6.5	20	CONTROLS		6.4	30	CONTROLS		1.5	150	2.7	1601		
194.00	7.5	20			7.4	30			2.5	175	2.7	4510		
196.0	9.5	20			9.4	30			4.5	250	2.7	6443		

CHECK FOR DOWNSTREAM CULVERT CAPACITY 10' x 12'

(ASSUMING NO WEIR UPSTREAM)

ELEV (MSL)	HW (ABOVE INVERT)	HW/D	Q	OVER DAM H	L	C	Q	ΣQ
[illegible]	0	0	0					0
[illegible]	4	0.4	420	VALUES OBTAINED				[illegible]
[illegible]	6	0.6	690	FROM "HYDRAULIC CHARTS				[illegible]
[illegible]	[illegible]	[illegible]	954	FOR THE SELECTION OF				[illegible]
[illegible]	[illegible]	[illegible]	1320	HIGHWAY CULVERTS"				[illegible]
[illegible]	[illegible]	[illegible]	1380	BUREAU OF PUBLIC ROADS				1380
[illegible]	[illegible]	1.2	1605	CHART 1 pg. 5-21				1605
[illegible]	[illegible]	[illegible]	[illegible]					[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	0	920
[illegible]	[illegible]	1.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2135
[illegible]	[illegible]	[illegible]	[illegible]	1.5	[illegible]	[illegible]	[illegible]	2735
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]


DISCHARGE (C.F.S.)
ELEVATION (M.S.L.)
CULVERT CAPACITY
TOP OF DAM
19.22 cfs
THEORETICAL CULVERT
SPILLWAY CAPACITY
0
600
1000
5000
5500

BY ... DATE ...
CHKD. BY ... DATE ...
SUBJECT ...

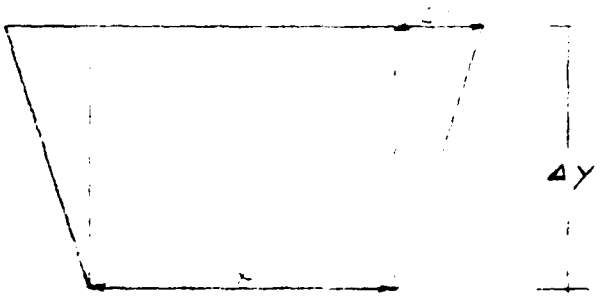
LOUIS BERGER & ASSOCIATES INC.

SHEET NO 4 OF ...
PROJECT ...

Area of lake @ El. 186.5 = 5 acres

Area at El. 200 = 20.2 acres

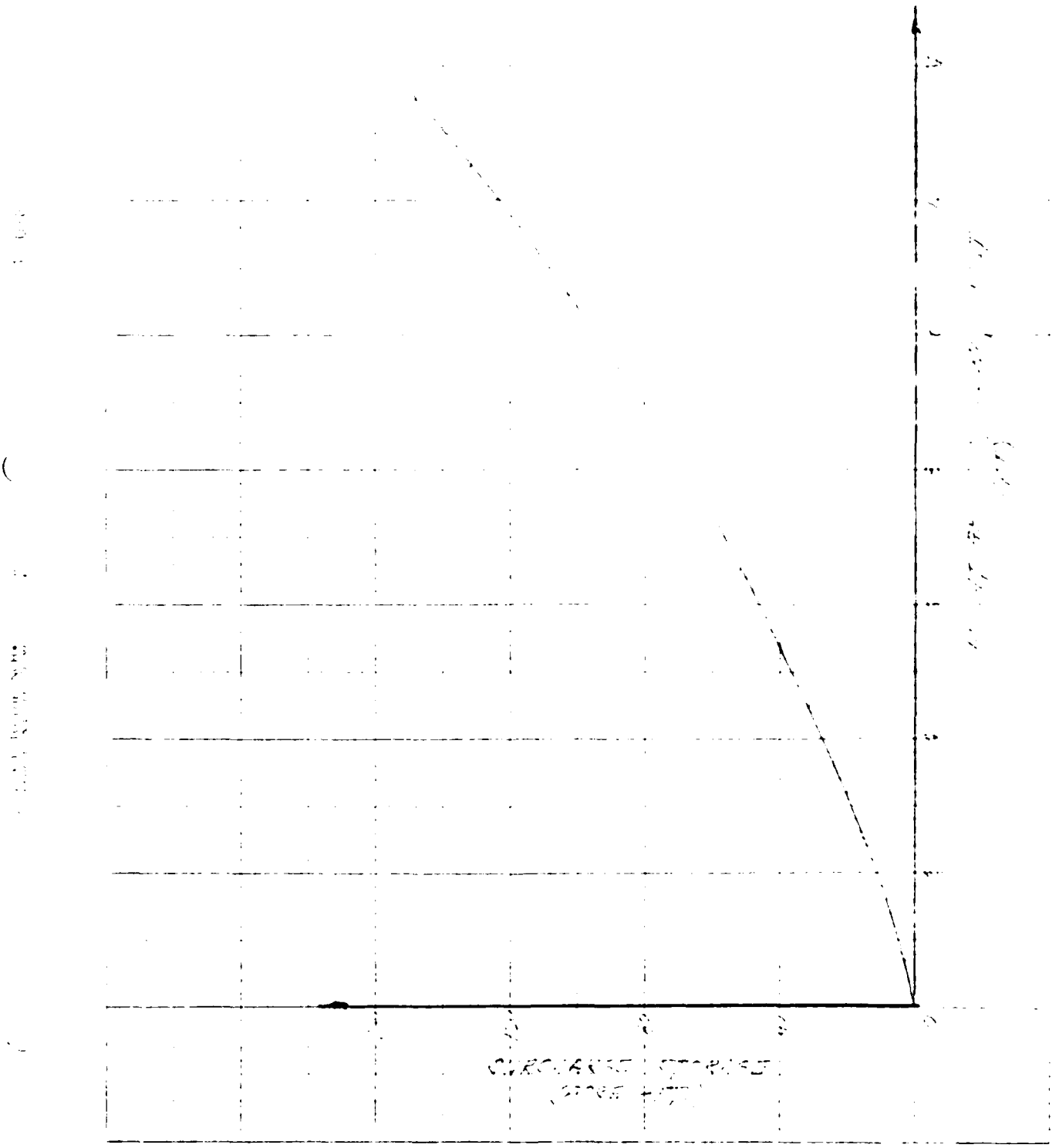
El. 200



El. 186.5

$\Delta v = \Delta y (x - \Delta x)$

Elev.	Height above spillway crest	(x+Δx) (acres)	Surcharge Stor. (Acre-feet)
186.5	0	5	0
187	0.5	5.23	2.64
188	1.5	5.84	8.76
189	2.5	6.4	16.23
190	3.5	6.97	24.43
191	4.5	7.58	33.89
192	5.5	8.10	44.55
193	6.5	8.66	56.23
194	7.5	9.22	68.15
195	8.5	9.79	80.21
196	9.5	10.35	93.36
197	10.5	10.91	106.56
198	11.5	11.47	131.91
199	12.5	12.04	150.50
200	13.5	12.60	170.10



BY DATE

CHKD BY DATE

SUBJECT

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 46 OF 83

PROJECT

LOUIS BERGER & ASSOCIATES INC.

BY [illegible] DATE [illegible] SHEET NO. 49 OF [illegible]

CHKD. BY ______ DATE ______ [illegible] PROJECT [illegible]

SUBJECT [illegible]

32" [illegible] FOR LOW LEVEL OUTLET

[illegible] HEAD AVAILABLE FOR [illegible]:
([illegible] WATER LEVEL AT SPILLWAY CREST i.e. EL. 193.50)

[illegible] AT INTAKE = 181.00
INVERT AT DISCH. = 176.00

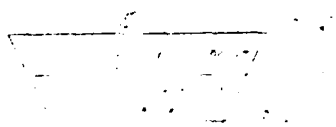
TOTAL HEAD AVAIL. = 10.5 FT.

CALCULATE LOSSES DUE TO 1) ENTRANCE COND. 0.20
2) ELBOW $K_e = 2 \times 0.10$ = 0.20
3) FRICTION $f \frac{L}{D} = 0.01 \times \frac{75}{3}$ = 0.33
4) GATE $K_g = 1.20$ = 1.20
FROM "DESIGN OF SMALL DAMS" P. 473-487 1.93

∴ TOTAL HEAD = 10.5 − 1.93 = 8.57 FT
ASSUME [illegible] OF 3 [illegible]
FROM TOP OF SPILLWAY TO TOP OF PIPE:
$Q = CA\sqrt{2gH_{avg}}$ ORIFICE FLOW

$Q = 0.62 \times 7.07 \sqrt{2 \times 32.2 \times [illegible]}$ = 59 cfs − 3 = [illegible] cfs
[illegible] H_{avg} = (8.57 − 3)/2 = 2.79
FROM TOP OF PIPE TO INVERT OF PIPE:
[illegible] = 8.57 − 2.5 − 1.5 = [illegible] FT H_{avg} = [illegible]

Q = [illegible] $\times 0.62 \times$ [illegible] = [illegible] cfs − 3 = [illegible] cfs



[illegible]

BY ... DATE 2/4/...

CHKD. BY ... DATE ...

SUBJECT ... HEC-1 OUTPUT

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A10 OF A13

PROJECT ... E-262

BRIANT PARK DAM
D LANG
AUGUST 26, 1980

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	15	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	-1	1.30	0.00	1.30	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.00	0.00	0.00

PRECIP PATTERN

0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.11	0.14	0.30
0.30	0.70	1.70	0.40	0.30	0.16	0.11	0.09	0.09	0.07
0.07	0.06	0.06	0.06						

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	0.00

GIVEN UNIT GRAPH, NUHGQ= 12

73.	256.	505.	615.	553.	424.	298.	210.	193.	104.
70.	51.								

UNIT GRAPH TOTALS 3352. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	RAIN	EXCS	COMP Q
1	0.06	0.00	0.
2	0.06	0.00	0
3	0.06	0.00	0
4	0.06	0.00	0
5	0.07	0.00	0
6	0.08	0.00	0.
7	0.09	0.00	0
8	0.11	0.07	5
9	0.14	0.12	25
10	0.30	0.27	85
11	0.30	0.27	191
12	0.70	0.67	368
13	1.70	1.67	696
14	0.40	0.08	1188
15	0.30	0.27	1695
16	0.16	0.13	1909
17	0.11	0.08	1792
18	0.09	0.07	1510
19	0.09	0.07	1193
20	0.07	0.04	944
21	0.07	0.04	779
22	0.06	0.03	655
23	0.06	0.03	423
24	0.06	0.03	310
25	0.00	0.00	194
26	0.00	0.00	150
27	0.00	0.00	117
28	0.00	0.00	78
29	0.00	0.00	54

BY _____ DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO _____ OF _____

CHKD. BY _____ DATE _____ _____ PROJECT _____

SUBJECT _____ _____

30	0.00	0.00	36
31	0.00	0.00	23
32	0.00	0.00	15
33	0.00	0.00	8
34	0.00	0.00	4
35	0.00	0.00	2
36	0.00	0.00	0
37	0.00	0.00	0
38	0.00	0.00	0
39	0.00	0.00	0
40	0.00	0.00	0
41	0.00	0.00	0
42	0.00	0.00	0
43	0.00	0.00	0
44	0.00	0.00	0
45	0.00	0.00	0
46	0.00	0.00	0.
47	0.00	0.00	0.
48	0.00	0.00	0.
49	0.00	0.00	0.
50	0.00	0.00	0
51	0.00	0.00	0
52	0.00	0.00	0
53	0.00	0.00	0
54	0.00	0.00	0
55	0.00	0.00	0.
56	0.00	0.00	0.
57	0.00	0.00	0
58	0.00	0.00	0.
59	0.00	0.00	0
60	0.00	0.00	0.
61	0.00	0.00	0.
62	0.00	0.00	0.
63	0.00	0.00	0
64	0.00	0.00	0
65	0.00	0.00	0
66	0.00	0.00	0
67	0.00	0.00	0
68	0.00	0.00	0
69	0.00	0.00	0
70	0.00	0.00	0
71	0.00	0.00	0
72	0.00	0.00	0.
73	0.00	0.00	0.
74	0.00	0.00	0
75	0.00	0.00	0.
76	0.00	0.00	0.
77	0.00	0.00	0
78	0.00	0.00	0
79	0.00	0.00	0
80	0.00	0.00	0
81	0.00	0.00	0
82	0.00	0.00	0
83	0.00	0.00	0
84	0.00	0.00	0
85	0.00	0.00	0
86	0.00	0.00	0
87	0.00	0.00	0.
88	0.00	0.00	0
89	0.00	0.00	0.
90	0.00	0.00	0.
91	0.00	0.00	0
92	0.00	0.00	0
93	0.00	0.00	0
94	0.00	0.00	0
95	0.00	0.00	0
96	0.00	0.00	0.
97	0.00	0.00	0
98	0.00	0.00	0
99	0.00	0.00	0
100	0.00	0.00	0
SUM	5.20	4.24	14347

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1909	597	149	143	14345
INCHES		4.27	4.28	4.28	4.28
AC-FT		296	297	297	297

BY _____ DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO _____ OF _____

CHKD. BY _____ DATE _____ PROJECT _____

SUBJECT _____

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HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	1	0	0	0	0	1

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	0

STORAGE=	0	3	9	16	24	34	45	69	115	132
OUTFLOW=	0	47	285	648	1116	1590	2135.	3785.	6850.	12707

TIME	EOP STOR	AVG IN	EOP OUT
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	3	1
9	0	16	5
10	1	55	21
11	3	139	67
12	5	280	189
13	11	530	404
14	18	942	779
15	27	1441	1253
16	35	1802	1627
17	38	1851	1781
18	36	1651	1691
19	31	1351	1459
20	26	1068	1193
21	22	862	957
22	18	667	745
23	14	489	564
24	12	368	431
25	9	253	310
26	7	172	227
27	6	130	171
28	5	95	127
29	4	66	92
30	3	45	65
31	3	29	46
32	2	19	37
33	2	12	29
34	1	6	22
35	1	3	16
36	1	1	11
37	0	0	8
38	0	0	5
39	0	0	4
40	0	0	2
41	0	0	2
42	0	0	1
43	0	0	1
44	0	0	1
45	0	0	0
46	0	0	0
47	0	0	0
48	0	0	0
49	0	0	0
50	0	0	0
51	0	0	0
52	0	0	0
53	0	0	0
54	0	0	0
55	0	0	0
56	0	0	0
57	0	0	0
58	0	0	0
59	0	0	0
60	0	0	0
61	0	0	0

62	0.	0	0
63	0	0	0
64	0	0	0.
65	0.	0.	0.
66	0	0	0
67	0	0	0
68	0	0.	0
69	0	0	0
70	0.	0	0
71	0	0	0
72	0	0.	0
73	0	0	0
74	0	0	0
75	0	0.	0
76	0.	0.	0.
77	0.	0.	0.
78	0.	0.	0.
79	0.	0.	0.
80	0.	0.	0.
81	0.	0.	0.
82	0.	0.	0.
83	0.	0.	0.
84	0.	0.	0.
85	0.	0.	0.
86	0.	0.	0.
87	0.	0.	0.
88	0.	0.	0.
89	0.	0.	0.
90	0.	0.	0.
91	0.	0.	0.
92	0.	0.	0.
93	0.	0.	0.
94	0.	0.	0.
95	0.	0.	0.
96	0.	0.	0.
97	0.	0.	0.
98	0.	0.	0.
99	0.	0.	0.
100	0.	0.	0.
SUM			14345.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1781.	594.	149	143	14345
INCHES		4.25	4.28	4.28	4.28
AC-FT		295.	297.	297.	297.

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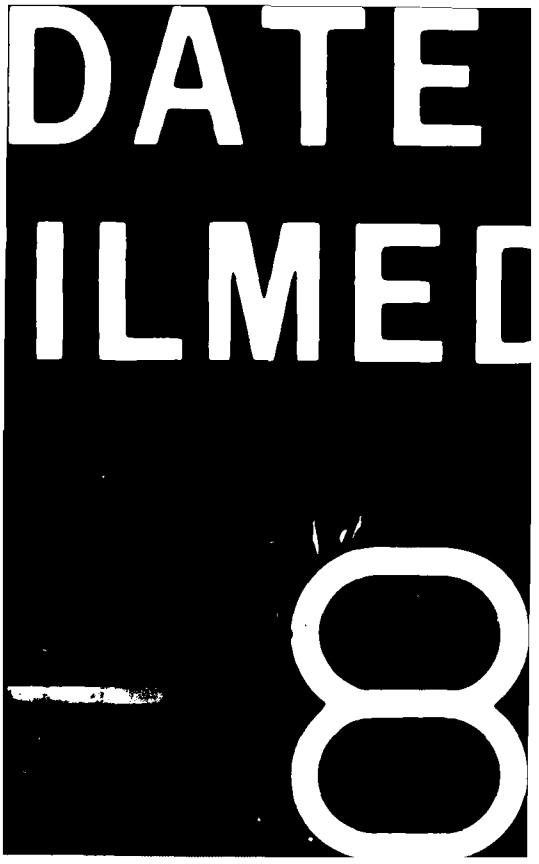
RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	1905	594	149	143.	1.30
ROUTED TO	1	1781	594	149	143.	1.30


DATE
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8